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(54) APPARATUS FOR MIXING INGREDIENTS OF SYNTHETIC PLASTICS COMPOSITIONS

(71) We, COWIE & RIDING LIMITED, a British Company, of 8/10 Salisbury Street, Blackburn, Lancashire, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to apparatus for mixing or blending the constituents or ingredients of synthetic plastics materials prior to initiation of synthesis, particularly in the production of foamed plastics.

In known mixers, the ingredients are fed into a mixing chamber and are mixed by a rotary mixing tool in the form of a disc carrying projections or vanes on the walls of the chamber.

With the known mixing devices, it is not possible to add agents or additives such as gelling agents to the mixture since the ingredients are not sufficiently mixed to permit this to be done successfully. In order to achieve this with gel foams, the mixed material has to be removed from the mixer and further material has to be removed from the mixer and further intimately mixed in a blender after which the gelling reactions are initiated, and the mixture is spread to form a sheet, prior to curing.

An object of the invention is to provide mixing apparatus of the kind referred to which renders subsequent use of a blender unnecessary, and which makes it possible to produce light density foams by causing entrainment of substantial amounts of air, and which will achieve better surface finish and finer cell structure.

The invention provides apparatus, for mixing or blending the constituents or ingredients of synthetic plastics material prior to initiation of synthesis, comprising a plurality of coaxial mixing chambers arranged for sequential flow of ingredients therethrough, each said chamber being substantially wholly occupied by a respective disc-like rotary mixing tool having, on its planar surfaces, projections arranged in circular arrays concentric with the axis of rotation of the disc and so positioned, relative to similarly-arranged projections on the walls defining the respective chamber, that on rotation of the mixing tool the projections thereof pass between the projections on the respective walls, the tools being mounted on a common drive shaft.

To permit mixing of an agent such as a gelling agent, a first inlet is preferably provided to the last of said mixing chambers, in the direction of said sequential flow, which inlet may be connected to a conduit connecting the mixer to a supply of such agent.

The projections may be in the form of vanes or tines.

The projections may be of tooth-like form with spaces therebetween in the direction of the circular arrays.

The disc-like rotary mixing tools may be composed of elements each in the shape of a segment of a circle.

A preferred embodiment of the mixing apparatus according to the invention will now be described, by way of example, with reference to the accompanying drawings, wherein:—

Fig. 1 is a longitudinal cross-section of the preferred embodiment of the mixing apparatus according to the invention, on line I—I of Fig. 2;

Fig. 2 is an end elevation from the right-hand side of Fig. 1 to a reduced scale; and

Fig. 3 is an elevation of a segment of a rotary mixing tool embodied in the apparatus of Figs. 1 and 2.

The mixing apparatus according to the invention is for use in mixing or blending the constituents or ingredients of synthetic plastics materials prior to initiation of synthesis, specifically for polyurethane foams for use as backings and underlays for carpets.

The apparatus comprises a cylindrical body 10 arranged for material to be mixed or blended to flow therethrough between an inlet provided by a tubular end boss 12 and

an outlet provided by a tubular end boss 13.

The interior of the body 10 is divided into three coaxial mixing chambers 14, 15 and 16 which are each concentric with the axis of the body 10, and are disposed sequentially in the axial direction of the body 10. The chambers 14, 15 and 16 are separated internally of the body by two dividing walls 17 and 18. The dividing walls 17 and 18 are formed with respective central apertures 19, 20 providing for communication between the adjacent chambers 14 and 15, and 15 and 16.

A drive shaft 21 extends through the end boss 12 and the three chambers 14, 15 and 16 and terminates in the last of the chambers 16, leaving the other end boss 13 unobstructed. The drive shaft 21 is journalled for rotation in the said end boss 12, and is secured against leakage by a gland packing 22. The drive shaft 21 is common to and carries three disc-like rotary mixing tools 23, 24 and 25 which are keyed by keys 26, 27 and 28 to the drive shaft 21 so as to be rotatable thereby. Each such mixing tool substantially wholly occupies its respective mixing chamber.

Each rotary mixing tool 23, 24 and 25 comprises a substantially disc-like member (which may be composed of elements each in the shape of a segment of a circle) having, on each planar surface, a plurality of perpendicularly-extending projections 29 which may be in the form of tooth-like vanes or tines. The projects 29 are disposed in a plurality of concentric circular arrays which are concentric with the axis of rotation of the shaft 21 and may be considered to be the product of forming gaps in a plurality of circular walls as is shown in Fig. 3.

The walls of each chamber 14, 15 and 16 are provided with similar projections 30 in a similar arrangement of concentric circular arrays, these arrays however being disposed in the circular spaces between the projections 29 of the mixing tools so that the latter can be rotated relatively to the body 10 without the projections fouling one another.

Constituents or ingredients of synthetic plastics material to be mixed or blended are introduced through an injection aperture 31 in the end bloss 12 in which the drive shaft 21 is journalled and flow along an annular passage 32 in the boss 12, which passage 32 opens into the first of the mixing chambers 14 adjacent the drive shaft 21. The ingredients enter into the mixing chamber 14 through an annular gap 33 between the mixing tool 23 and the chamber wall and are mixed or blended by relative rotation of the projections 30 on the wall and the projections 29 on the mixing tool 23. The ingredients are forced radially outwardly to the periphery of the mixing tool 23 and around the outer edge 34 of the mixing tool and return radially inwardly over the opposed planar surface of the mixing tool 23 and the other wall 17 of the chamber 14, to flow from the latter and into the next adjacent mixing chamber 15 by way of the central aperture 19.

The same procedure of entry at the centre of the chamber 15 or 16, radial outward movement over the adjacent planar surface of the respective rotor 24 or 25 to the periphery thereof, and return from the periphery radially inwards over the opposed planar surface of the rotor 24 or 25 to the centre thereof is repeated in each of the two other chambers 15 and 16 of the mixer. Accordingly the ingredients to be mixed flow sequentially through the three mixing chambers 14, 15 and 16.

In the last chamber 16 a first inlet 36 is provided at a position on the periphery of the chamber to permit introduction of a gelling agent.

The mixture leaves the last chamber 16 through the second end boss 13.

At a point on the periphery of the first chamber 14 a second inlet 35 is provided to permit introduction of liquid additives such as dyes or lubricants.

In order to avoid the possibility of the body 10 being constrained to rotate with the mixing tools 23 to 25 and causing uncoupling by unscrewing of the end bosses 12 and 13 from their supporting nuts 37 and 38 respectively, the end boss 12 engages in to its nut 37 by a left-hand thread and the second boss 13 engages with its corresponding nut 38 by a right-hand thread, so that any such rotation of the body 10 merely tends to tighten the bosses 12 and 13.

The body 10 is made up of six dished members 39, 40, 41, 42, 43 and 44, substantially of disc-like form with upstanding rims. The rims define the peripheral walls of the mixing chambers 14, 15, 16, and the dished members 39 to 44 are assembled in pairs so that one member at each end has its rim facing inwardly and defines the respective end of the mixer body, while the remaining members are arranged in pairs of back-to-back arrangements. The annular join between the rims of the members which occurs in the middle of each mixing chamber's peripheral wall is sealed in known manner with a respective sealing ring 45.

The back-to-back surfaces of the remaining dished members are each formed with a respective broad recess 46, and when the members are assembled in the back-to-back positions, these recesses provide spaces for circulation of a coolant.

A passage 47 is provided in the wall of the body defined by the rims of the members 39 to 44, which passage 47 communicates with each of the spaces 46 for the circulation of the coolant, which may be water. The members 39 to 44 are secured by a plurality

of equally circumferentially-spaced bolts 48.

The invention is not limited in respect of number of chambers which are present in the mixer. There may be as few as two, or more than three chambers.

The form of the projections on the rotary mixing tools and the chamber walls can be varied as appropriate for various purposes. For example if the formulation for a material includes mineral fillers, the projections may be coarser than where no such fillers are used.

WHAT WE CLAIM IS:—

1. Mixing apparatus, for mixing or blending the constituents or ingredients of synthetic plastics material prior to initiation of synthesis, comprising a plurality of coaxial mixing chambers arranged for sequential flow of ingredients therethrough, each said mixing chamber being substantially wholly occupied by a respective disc-like rotary mixting tool having, on its planar surfaces, projections arranged in circular arrays concentric with the axis of rotation of the disc and so positioned, relative to similarly-arranged projections on the walls defining the respective chamber, that on rotation of the mixing tool the projections thereof pass between the projections on the respective walls, the tools being mounted on a common drive shaft.

2. Mixing apparatus as claimed in claim 1, wherein the projections are in the form of vanes or tines.

3. Mixing apparatus as claimed in claim 1 or 2, wherein the projections are of tooth-like form with gaps therebetween in the direction of the circular arrays.

4. Mixing apparatus as claimed in claim 1, 2 or 3, wherein said disc-like rotary mixing tools are composed of elements each in the shape of a segment of a circle.

5. Mixing apparatus as claimed in any preceding claim, wherein a first inlet is provided to the last of said mixing chambers in the direction of sequential flow, to permit introduction of an agent, such as a gelling agent.

6. Mixing apparatus as claimed in claim 5, wherein said first inlet is connected to a conduit connecting the mixing apparatus to a supply of said agent.

7. Mixing apparatus as claimed in any preceding claim, wherein second inlet is provided to the first of the mixing chambers in the direction of sequential flow, to permit the introduction of one or more liquid additives, such as dyes or lubricants.

8. Mixing apparatus as claimed in any preceding claim, wherein a passage is provided in the wall of the body of the mixing apparatus to permit circulation of a suitable coolant, such as water.

9. Mixing apparatus substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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2 SHEETS This drawing is a reproduction of the Original on a reduced scale
Sheet 1

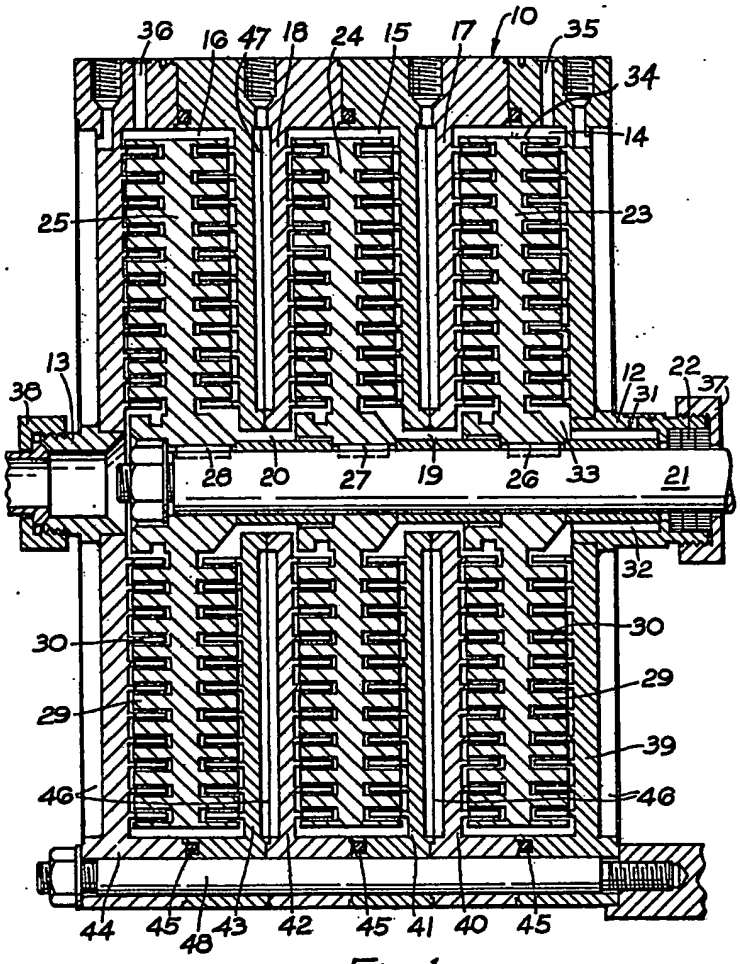

Fig. 1.

1390180 COMPLETE SPECIFICATION
2 SHEETS This drawing is a reproduction of the Original on a reduced scale
Sheet 2

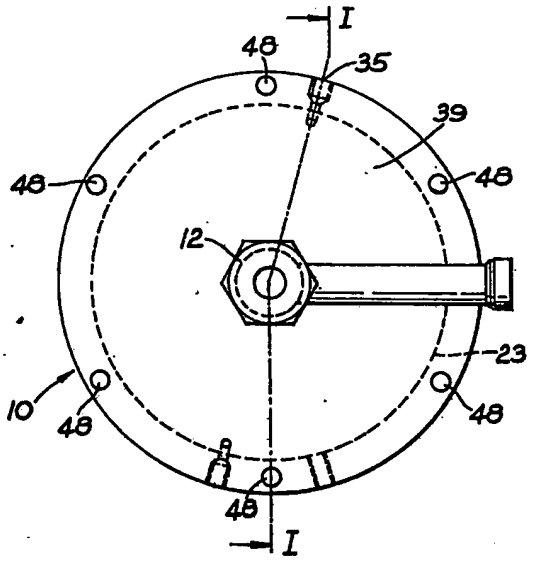

Fig. 2.

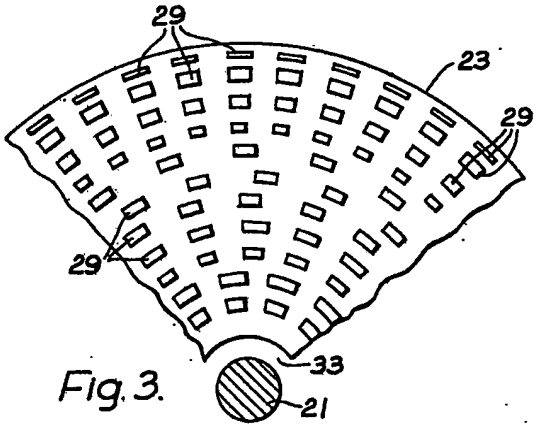

Fig. 3.